

**UTILITY
PATENT APPLICATION
TRANSMITTAL**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.

35.C14250

First Named Inventor or Application Identifier

YUKINORI YAMAMOTO

Express Mail Label No.

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

ADDRESS TO:

Assistant Commissioner for Patents
Box Patent Application
Washington, DC 20231

1. ☐ Fee Transmittal Form
(Submit an original, and a duplicate for fee processing)

2. ☒ Specification Total Pages

3. ☒ Drawing(s) (35 USC 113) Total Sheets

4. ☒ Oath or Declaration Total Pages

a. ☐ Newly executed (original or copy)

b. ☒ Unexecuted for information purposes

c. ☐ Copy from a prior application (37 CFR 1.63(d))
(for continuation/divisional with Box 17 completed)
[Note Box 5 below]

i. ☐ **DELETION OF INVENTOR(S)**
Signed Statement attached deleting
inventor(s) named in the prior application, see
37 CFR 1.63(d)(2) and 1.33(b).

5. ☐ Incorporation By Reference (useable if Box 4c is checked)
The entire disclosure of the prior application, from which a copy of
the oath or declaration is supplied under Box 4c, is considered as
being part of the disclosure of the accompanying application and is
hereby incorporated by reference therein.

6. ☐ Microfiche Computer Program (Appendix)

7. Nucleotide and/or Amino Acid Sequence Submission
(if applicable, all necessary)

a. ☐ Computer Readable Copy

b. ☐ Paper Copy (identical to computer copy)

c. ☐ Statement verifying identity of above copies

ACCOMPANYING APPLICATION PARTS

8. ☐ Assignment Papers (cover sheet & document(s))

9. ☐ 37 CFR 3.73(b) Statement ☐ Power of Attorney
(when there is an assignee)

10. ☐ English Translation Document (if applicable)

11. ☐ Information Disclosure ☐ Copies of IDS
Statement (IDS)/PTO-1449 Citations

12. ☐ Preliminary Amendment

13. ☒ Return Receipt Postcard (MPEP 503)
(Should be specifically itemized)

14. ☐ Small Entity ☐ Statement filed in prior application
Statement(s) Status still proper and desired

15. ☐ Certified Copy of Priority Document(s)
(if foreign priority is claimed)

16. ☐ Other: _____

17. If a CONTINUING APPLICATION, check appropriate box and supply the requisite information:

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP) of prior application No.

18. CORRESPONDENCE ADDRESS

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05514
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CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
	TOTAL CLAIMS (37 CFR 1.16(c))	14-20 =	0	X \$ 18.00 =	\$ 0.00
	INDEPENDENT CLAIMS (37 cfr 1.16(b))	3-3 =	0	X \$ 78.00 =	\$ 0.00
	MULTIPLE DEPENDENT CLAIMS (if applicable) (37 CFR 1.16(d))			\$260.00 =	\$ 0.00
				BASIC FEE (37 CFR 1.16(a))	\$690.00
			Total of above Calculations =		\$690.00
	Reduction by 50% for filing by small entity (Note 37 CFR 1.9, 1.27, 1.28).				
	TOTAL =				\$690.00

19. Small entity status

- a. ☐ A Small entity statement is enclosed
b. ☐ A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
c. ☐ Is no longer claimed.

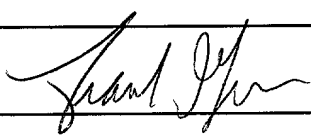
20. ☒ A check in the amount of \$690.00 to cover the filing fee is enclosed.

21. ☐ A check in the amount of \$_____ to cover the recordal fee is enclosed.

22. The Commissioner is hereby authorized to credit overpayments or charge any deficiencies in the following fees to Deposit Account No. 06-1205:

- a. ☒ Fees required under 37 CFR 1.16.
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SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

NAME	FRANK A. DeLUCIA, JR., Reg. No. 42,476
SIGNATURE	
DATE	February 9, 2000

DECODING APPARATUS AND METHOD, AND STORAGE
MEDIUM STORING DECODING PROCESSING PROGRAM OF THE SAME

BACKGROUND OF THE INVENTION

5 Field of the Invention

The present invention relates to a data decoding apparatus and method, and a storage medium and, more particularly, to decoding processing of decoding a bitstream such as coded and multiplexed image and audio signals in a digital TV reception apparatus or a digital storage medium reproduction apparatus.

Related Background Art

Fig. 1 shows a conventional decoding apparatus for decoding a coded bitstream. Fig. 1 shows the arrangement of a digital broadcasting receiver that has an accounting function. Referring to Fig. 1, the apparatus comprises a bitstream input terminal 101 for receiving a coded bitstream, descrambling circuit 102, and separation circuit 103 for separating multiplexed data.

The apparatus also has an audio signal decoding circuit 104 for decoding a separated audio signal, a video signal decoding circuit 105 for decoding a separated video signal, a CPU 106, an IC card 107, and a remote controller 108. The operation of the conventional digital broadcasting receiver will be described below with reference to Fig. 1.

A bitstream received by a tuner (not shown) in Fig. 1 is input from the input terminal 101 to the apparatus. As the coding scheme, so-called MPEG (Moving Picture Experts Group) 2 is used.

5 In this input stream, normally, a coded audio signal and video signal are multiplexed and scrambled to permit only a specific user to view the contents.

10 A method of confirming viewing permission will be described later. If viewing is permitted, the stream input to the descrambling circuit 102 is descrambled by a descrambling key given by the CPU 106 and input to the separation circuit 103.

15 The separation circuit 103 separates the stream into an audio signal stream and a video signal stream, which are supplied to the decoding circuits 104 and 105, respectively, decoded, and displayed on a monitor (not shown). Control lines from the CPU 106 are connected to the audio signal decoding circuit 104 and video signal decoding circuit 105 to control
20 stereo/multi-lingual data or display information on the screen.

A method of confirming viewing permission (authentication method) will be described.

25 A subscribed program ID and descrambling key are stored in the IC card 107 in advance. To watch the program, the CPU 106 accesses the IC card 107 and confirms viewing permission on the basis of whether the

program ID stored in the IC card and the program of the input stream coincide with each other. In this case, programs that are not subscribed in advance cannot be watched.

5 Conventionally, however, in any schemes, viewing is limited in units of channels or in units of programs. In addition, only ON/OFF-control can be performed. For this reason, it is difficult to provide higher-quality video data in accordance with
10 subscription or provide an interactive program.

 In recent years, large-capacity media such as DVD are becoming popular, and not only fixed control for reproduction/non-reproduction but also a variety of flexible use forms that take advantage of the large
15 capacity are required. However, such a service is hard to realize.

SUMMARY OF THE INVENTION

 The present invention has been made in
20 consideration of the above situation, and has as its object to provide a decoding apparatus and method and a storage medium storing a decoding processing program, which permit to set a multi-level reproduction processing of an object when bitstream which is coded
25 and multiplexed in units of a plurality of objects is decoded.

In order to achieve the above object, according to an aspect of the present invention, there is provided a decoding apparatus/method in which a bitstream obtained by coding a plurality of object data in units of
5 objects and multiplexing the coded data is input, coded data of each object is separated from the bitstream, a predetermined object is selected from the plurality of objects contained in the bitstream, the coded data of the selected object is decoded and object data is
10 output, and the decoded object data is synthesized.

According to another aspect of the present invention, there is provided a computer-readable storage medium which stores a decoding program comprising input processing of inputting a bitstream
15 obtained by coding a plurality of object data in units of objects and multiplexing the coded data, separation processing of separating coded data of each object from the bitstream, selection processing of selecting a predetermined object from the plurality of objects
20 contained in the bitstream, decoding processing of decoding the coded data of the selected object and outputting object data, and synthesis processing of synthesizing the decoded object data.

Other objects, features and advantages of the
25 invention become apparent from the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram showing the arrangement of a conventional decoding apparatus;

Fig. 2 is a block diagram showing the arrangement of a decoding apparatus according to an embodiment;

Figs. 3A, 3B, 3C and 3D are views for explaining the operation of a priority decoder; and

Fig. 4 is a block diagram showing details of a synthesization circuit 210 shown in Fig. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In recent years, MPEG4 has received a great deal of attention as a new coding scheme. As some characteristic features of MPEG4, it has scalability in space and time, and additionally, it divides video data into a plurality of objects (e.g., background and persons), and codes and multiplexes respective data, unlike the conventional MPEG2.

As some other characteristic features, coding and multiplex corresponding to CG or animation are possible, and the error resilience is high. This embodiment places an emphasis on the processing of a plurality of objects. In this embodiment, an MPEG4 bitstream is decoded.

Fig. 2 is a block diagram showing the arrangement of a decoding apparatus according to this embodiment.

Referring to Fig. 2, the decoding apparatus has an antenna 201 for receiving a broadcasting signal, and a tuner 202 for demodulating the reception signal received by the antenna 201 to obtain a coded
5 bitstream.

The apparatus also has a descrambling circuit 203, a separation circuit 204 for separating multiplexed data, and an audio signal decoding circuit 205 for decoding a separated audio signal.

10 Decoding circuits 206 to 208 decode separated VOP (Video Object Plane) signals, respectively. A scene description decoding circuit 209 decodes a scene description. A synthesization circuit 210 synthesizes the audio signal and VOP signals.

15 The decoding apparatus also has switches 211 to 213, a priority decoder 214, a communication circuit 215 for connecting the apparatus to a communication line such as a telephone line or a line of the Internet or cable TV, a CPU 216, an IC card 217, a remote
20 controller 218, and a display apparatus 219 for audio and image output.

The processing operation of the decoding apparatus of this embodiment having the above-described arrangement will be described below.

25 An MPEG4 bitstream obtained through the antenna 201 and tuner 202 or an MPEG4 bitstream obtained through the communication circuit 215 is selectively

input to the descrambling circuit 203. If viewing is permitted, a descrambling key is supplied from the CPU 216, and the descrambling circuit 203 descrambles the bitstream.

5 If viewing is not permitted, video data for notifying the user that viewing is not permitted is generated by the CPU 216 and displayed on the display apparatus 219 through the synthesization circuit 210.

10 A method of authenticating viewing permission will be described below.

 First, the user subscribes to a management center (a company that supplies bitstreams or a management company entrusted by the company) through the communication circuit 215 in advance, downloads a
15 program ID and descrambling key from the management center, and stores them in the IC card 217.

 To manage and protect intellectual properties such as a copyright contained in the MPEG4 bitstream, the bitstream contains IPMP (Intellectual Property and
20 Management Protection) data. The IPMP data contains the same program ID as that stored in the IC card 217.

 The CPU 216 extracts the IPMP data from the bitstream input to the descrambling circuit 203 and detects the program ID.

25 Next, the CPU 216 reads out the program ID stored in the IC card 217 and authenticates whether the readout program ID coincides with the program ID

detected from the IPMP data. If the two program IDs coincide with each other, it is determined that viewing is permitted. In this case, the program cannot be watched unless the user subscribes in advance.

5 In addition to the above method, a method that charges for viewing can also be used to obtain viewing permission.

 In this case, a descrambling key used for descrambling and communication information (e.g., a
10 URL) for contact with the management center are contained in the IPMP data. The viewer can descramble the data using the descrambling key contained in the IPMP data at any time. When the descrambling key is used, personal information and viewing record stored in
15 the IC card 217 are transmitted to the management center on the basis of the communication information, and charges incurred are billed later. That is, a pay-per-view scheme is employed.

 In this embodiment, a viewing age limiting
20 function is prepared. Unless a password is input through the remote controller 218, a specific program (e.g., an adult program) cannot be watched (descrambled) even if charges have been payed.

 Processing after viewing is permitted and the data
25 is descrambled by the above-described method will be described next.

The descrambled stream is separated by the separation circuit 204 into streams such as audio, VOP0, VOP1, VOP2, and scene description streams. VOP is the basic unit of a video image in MPEG4 and actually represents the instantaneous value (image) of a video object.

MPEG4 has a number of layers including an upper layer called a VOL (Video Object Layer) in which, e.g., a VOP is expanded in space or time to increase resolution, and a VO (Video Object) that is a collection of VOLs. In this embodiment, a basic VOP will be exemplified for the descriptive convenience. The number of VOPs is limited to three in this example.

The streams separated by the separation circuit 204 are decoded by the audio signal decoding circuit 205, VOP decoding circuits 206, 207, and 208, and scene description decoding circuit 209, synthesized by the synthesization circuit 210, and output to the display apparatus 219.

The scene description is a description using a language, which positions VOPs divided into objects in space and synchronizes them in time to obtain one video image (audio data is also regarded as one object and synchronized in time).

The reason why not only spatial positioning but also temporal synchronization is necessary is that each object is influenced by time shift due to multiplex or

variations due to decoding delay. Actually, buffers must be prepared on the input and outputs sides of each decoding circuit in Fig. 2, although they are omitted in Fig. 2 for the illustrative convenience.

5 Referring back to Fig. 2, the switches 211, 212, and 213 determine whether VOP decoding outputs are to be output to the synthesization circuit 210. When these switches are turned off, an output different from the original MPEG4 video output is obtained.

10 More specifically, when a certain switch is turned off, an object corresponding to the switch is not displayed on the screen. The switches 211, 212, and 213 are ON/OFF-controlled by the priority decoder 214.

15 The priority decoder 214 functions as shown in Figs. 3A to 3D. That is, the priority decoder 214 ON/OFF-controls the switches 211 to 213 in accordance with a value output from the CPU 216. When priority decoder VOP0, 1, 2,... are assigned sequentially from an important video object in advance before coding
20 video data, an integer value 0, 1, 2, or 3 is supplied in accordance with the subscription of the user, thereby providing a service by preparing a multiple of resolutions to one program.

25 As the subscription procedures, only one extra integer value for object selection is stored in the IC card in addition to the program ID and descrambling key. In pay-per-view as well, the numerical value need

only be added to viewing information to be transmitted to the management center.

An explicit example of discrimination of the service will be described with reference to the block diagram of Fig. 4. Fig. 4 shows a specific example of the synthesization circuit 210 shown in Fig. 2. A VOP in Fig. 4 corresponds to a VOL in which the VOP is expanded to increase resolution. VOP0 is an image having the lowest resolution. If VOP1 and VOP2 are not given, an image obtained by simply expanding a subwindow in the vertical and horizontal directions is obtained as a video output.

VOP1 or VOP2 is high-resolution image information. When VOP1 or VOP2 is supplied to the synthesization circuit 210, an image with higher resolution is obtained as a video output. Hence, images of a plurality of image quality levels can be provided in units of subscription contents of users in correspondence with a common bitstream in accordance with integer values according to the subscriptions.

The numerical values shown in Figs. 3A to 3D will be exemplified. A user who has subscribed to "3" in Fig. 3D receives a service with the highest image quality. Referring to only Figs. 3A to 3D, it appears this system can be implemented using MPEG2 hierarchical coding. However, herein the basic concept is "video object", and the resolution of only an object (part) on

the window can be changed. MPEG2 permits only hierarchical coding targeting the entire picture.

A supplementary explanation will be done below in association with this embodiment. In this embodiment,
5 the priority of VOPs is determined using integer values. Instead, command mnemonic or the like may be used. Alternatively, the current level may be stored, and the level may be changed by an UP/DOWN command.

In this embodiment, the integer values coincide
10 with the number of VOPs to be decoded. Since the number of VOPs always varies, a ratio to the maximum allowable number of VOPs (e.g., 50% decoding or 20% decoding) may be used as an index.

Referring to Fig. 2, the switches 211, 212, and
15 213 are controlled to determine the priority of the VOPs. However, the VOP decoding circuits 206, 207, and 208 may be controlled to inhibit that decoding is performed selectively.

Instead of using the priority decoder 214, direct
20 control may be done by the CPU 216 (decoding by software). In this embodiment, audio objects have not been mentioned. For example, for an application in which a plurality of audio data are multiplexed in a one-to-one correspondence with VOPs, processing for
25 VOPs in this embodiment can be applied.

When this embodiment is applied while multiplexing a plurality of scene descriptions, a service with a

more flexible hierarchical structure can be provided as compared to this embodiment in which priority is given to VOPs. In this embodiment, the description has been made assuming broadcasting. However, this embodiment
5 can also be applied to package media such as a DVD.

This embodiment can also be applied to an interactive (bidirectional) application such as a quiz program because ON/OFF control and other control can be performed in units of objects.

10 As described above, according to this embodiment, the precision when a bitstream coded and multiplexed in units of a plurality of objects is separated into object streams and decoded can be controlled to a plurality of levels. For this reason, a variety of
15 flexible services can be realized for an input bitstream. For example, in a broadcasting medium, viewing can be conventionally limited in units of channels or in units of programs. In addition, only ON/OFF control can be performed. However, a
20 high-quality image can be provided in accordance with the subscription even for one program.

In addition, additional circuits or additional software for priority assignment can be minimized. When priority is given to VOPs on the coding side, any
25 large failure can be avoided even in an apparatus having a low ability and capable of decoding only two VOPs on the receiving side.

The present invention may be applied to a system constituted by a plurality of devices (e.g., a host computer or an interface device) or an apparatus comprising a single device.

5 The present invention also incorporates an arrangement in which various devices are operated such that the function of the embodiment is realized by supplying software program codes for realizing the function of the above embodiment to the computer in the
10 apparatus or system connected to the various devices, and causing the various devices to operate in accordance with the program stored in the computer (CPU or MPU) of the system or apparatus.

15 In this case, the software program codes realize the function of the above-described embodiment by themselves, and the program codes or means for supplying the program codes to the computer, e.g., a storage medium storing the program codes constitute the present invention. As a storage medium storing the
20 program codes, a floppy disk, a hard disk, an optical disk, a magnetooptical disk, a CD-ROM, a magnetic tape, a nonvolatile memory card, a ROM, or the like can be used.

25 The function of the above-described embodiment is realized not only when the supplied program codes are executed by the computer but also when the OS (Operating System) running on the computer realizes the

function of the above embodiment in collaboration with those program codes.

5 The present invention also incorporates an arrangement in which the function of the above-described embodiments is realized when the supplied program codes are written in the memory of a function expansion board inserted into the computer or a function expansion unit connected to the computer, and the CPU of the function expansion board or function expansion unit performs part or all of actual processing on the basis of the instructions of the program codes.

10 In other words, the foregoing description of embodiments has been given for illustrative purposes only and not to be constructed as imposing any limitation in every respect.

15 The scope of the invention is, therefore, to be determined solely by the following claims and not limited by the text of the specifications and alternations made within a scope equivalent to the scope of the claims fall within the true spirit and scope of the invention.

WHAT IS CLAIMED IS:

1. A decoding apparatus comprising:

- 5 a) input means for inputting a bitstream obtained by coding a plurality of object data in units of objects and multiplexing the coded data;
- b) separation means for separating coded data of each object from the bitstream;
- 10 c) selection means for selecting a predetermined object from the plurality of objects contained in the bitstream;
- d) decoding means for decoding the coded data of the object selected by said selection means and outputting object data; and
- 15 e) synthesis means for synthesizing the object data decoded by said decoding means.

2. An apparatus according to claim 1, wherein the bitstream is a bitstream complying with MPEG4.

20 3. An apparatus according to claim 1, wherein the bitstream input to said input means is scrambled, and said input means comprises descrambling means for descrambling the scrambled bitstream.

25 4. An apparatus according to claim 3, wherein

the bitstream contains IPMP data that is not scrambled, and said descrambling means descrambles the scrambled bitstream in accordance with the IPMP data.

5 5. An apparatus according to claim 3, wherein
said apparatus further comprises read means for
reading descrambling data for descrambling the
scrambled data, the descrambling data being stored in
an IC card, and said descrambling means descrambles the
10 scrambled bitstream in accordance with the descrambling
data read by said read means.

 6. An apparatus according to claim 1, wherein
said apparatus further comprises read means for
15 reading selection data for selecting the object, the
selection data being stored in an IC card, and said
selection means selects the predetermined object from
the plurality of objects in accordance with the
selection data read by said read means.

20

 7. An apparatus according to claim 1, wherein
the plurality of objects include at least a video
object.

25 8. An apparatus according to claim 7, wherein
the plurality of objects include at least an audio
object.

9. An apparatus according to claim 8, wherein
the plurality of objects include at least a scene
description object.

5 10. An apparatus according to claim 1, further
comprising

monitor means for monitoring the object data
synthesized by said synthesis means.

10 11. An apparatus according to claim 1, further
comprising

communication means for performing data
communication with an external device, said
communication device transmitting, to said external
15 device, information representing that the bitstream is
decoded.

12. An apparatus according to claim 11, wherein
said communication means performs data
20 communication through the Internet.

13. A decoding method comprising the steps of:
inputting a bitstream obtained by coding a
plurality of object data in units of objects and
25 multiplexing the coded data;
separating coded data of each object from the
bitstream;

selecting a predetermined object from the plurality of objects contained in the bitstream;

decoding the coded data of the selected object and outputting object data; and

5 synthesizing the decoded object data.

14. A computer-readable storage medium which stores a program, said program comprising steps of:

a) input processing of inputting a bitstream
10 obtained by coding a plurality of object data in units of objects and multiplexing the coded data;

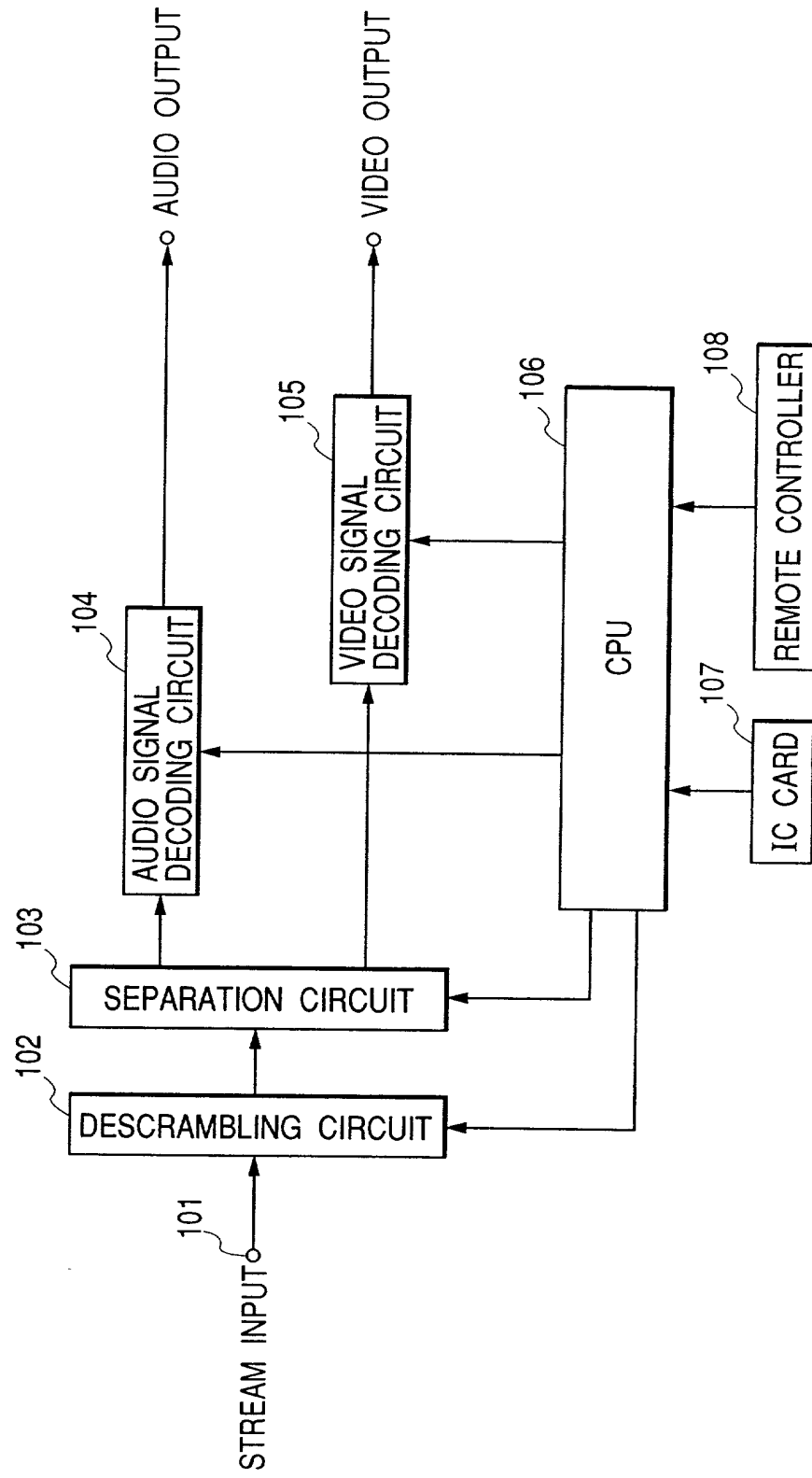
b) separation processing of separating coded data of each object from the bitstream;

c) selection processing of selecting a
15 predetermined object from the plurality of objects contained in the bitstream;

d) decoding processing of decoding the coded data of the selected object and outputting object data; and

e) synthesis processing of synthesizing the
20 decoded object data.

FIG. 1



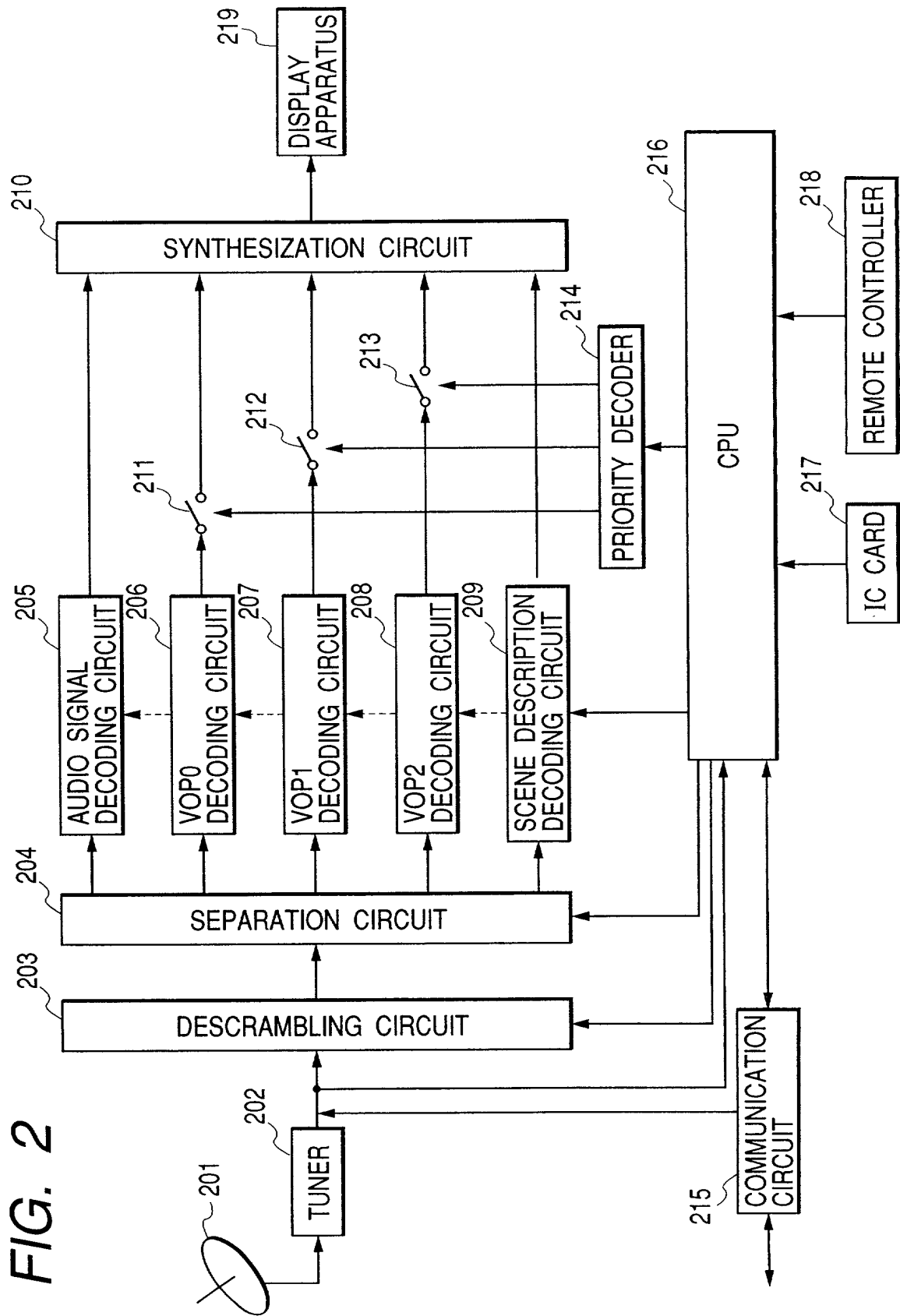


FIG. 3A

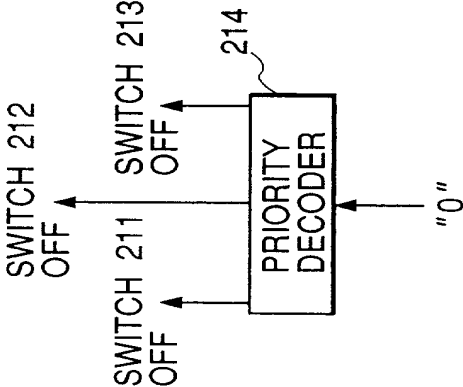


FIG. 3B

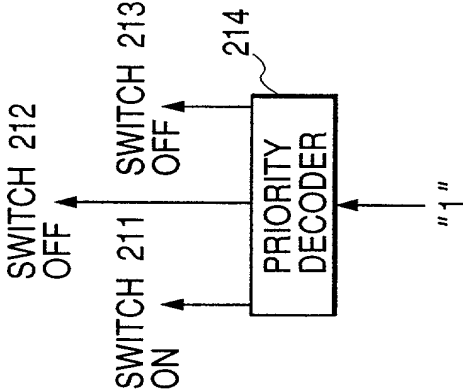


FIG. 3C

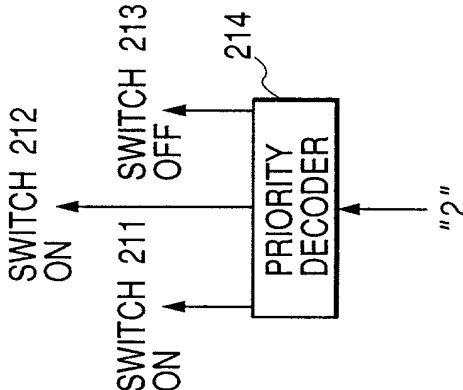


FIG. 3D

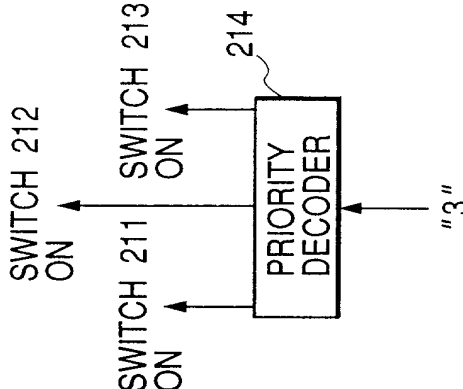
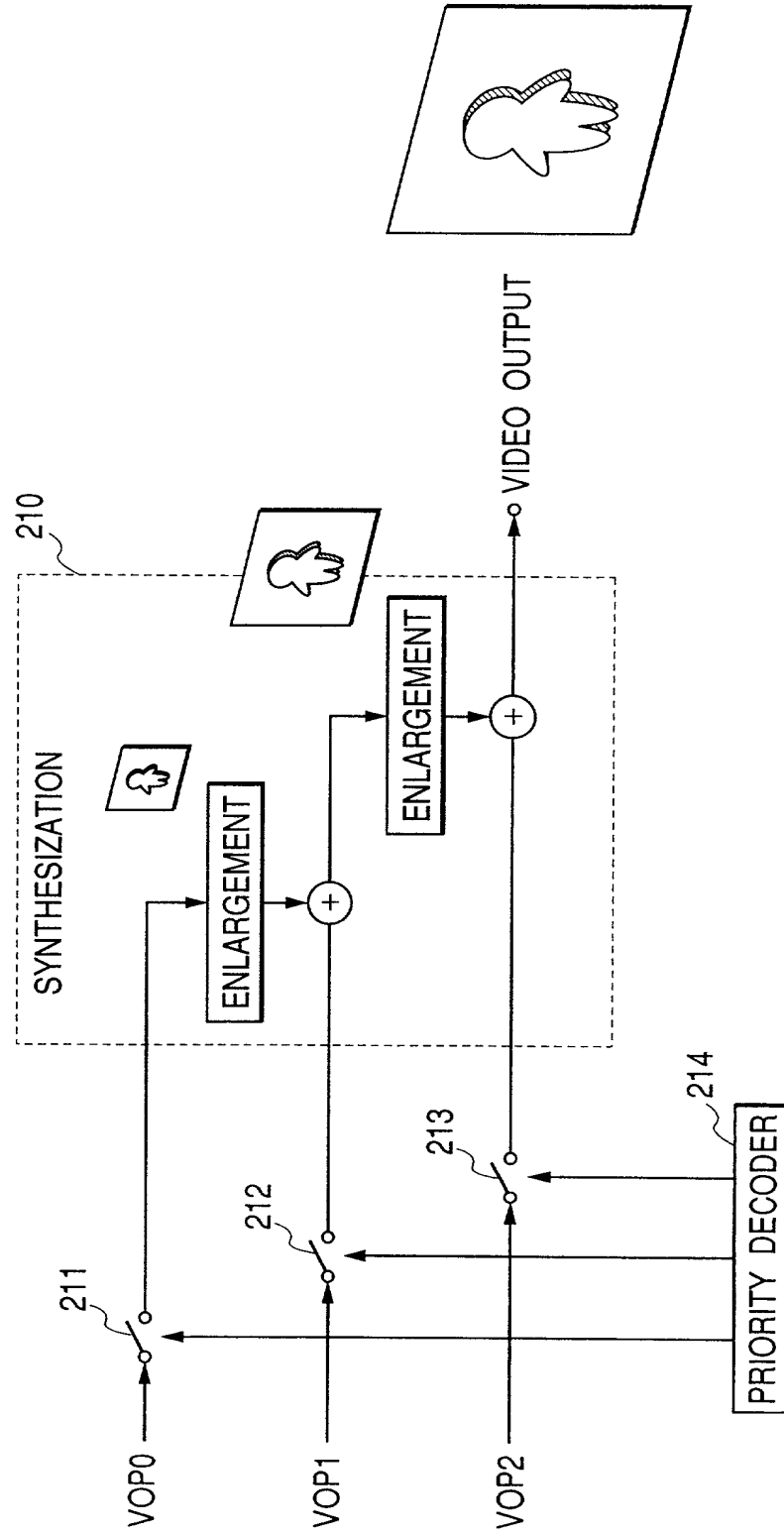


FIG. 4



**COMBINED DECLARATION AND POWER OF ATTORNEY
FOR PATENT APPLICATION
(Page 1)**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

DECODING APPARATUS AND METHOD, AND STORAGE MEDIUM
STORING DECODING PROCESSING PROGRAM OF THE SAME
the specification of which ☒ is attached hereto ☐ was filed on _____
as United States Application No. or PCT International Application No. _____
and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b), of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designates at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT international application having a filing date before that of the application on which priority is claimed:

Country	Application No.	Filed (Day/Mo./Yr.)	(Yes/No) Priority Claimed
Japan	11-039582	February 18, 1999	Yes

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT international application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

Application No.	Filed (Day/Mo./Yr.)	Status (Patented, Pending, Abandoned)
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I hereby appoint the practitioners associated with the firm and Customer Number provided below to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith, and direct that all correspondence be addressed to the address associated with that Customer Number:

FITZPATRICK, CELLA, HARPER & SCINTO
Customer Number: 05514

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole or First Inventor YUKINORI YAMAMOTO

Inventor's signature _____

Date _____ Citizen/Subject of JAPAN

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Kawasaki-shi, Kanagawa-ken, Japan

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30-2, Shimomaruko 3-chome, Ohta-ku, Tokyo, Japan